

Environmental Protection Agency

§ 86.1868–12

Where:

LeakThreshold = 11.0 for air conditioning systems with a refrigerant capacity less than or equal to 733 grams; or

LeakThreshold = [Refrigerant Capacity × 0.015] for air conditioning systems with a refrigerant capacity greater than 733 grams, where RefrigerantCapacity is the maximum refrigerant capacity specified for the air conditioning system, in grams.

(c) The total leakage reduction credits generated by the air conditioning system shall be calculated separately for passenger automobiles and light trucks according to the following formula:

Total Credits (Megagrams) = (Leakage × Production × VLM) ÷ 1,000,000

Where:

Leakage = the CO₂-equivalent leakage credit value in grams per mile determined in paragraph (b)(1) or (b)(2) of this section, whichever is applicable.

Production = The total number of passenger automobiles or light trucks, whichever is applicable, produced with the air conditioning system to which the leakage credit value from paragraph (b)(1) or (b)(2) of this section applies.

VLM = vehicle lifetime miles, which for passenger automobiles shall be 195,264 and for light trucks shall be 225,865.

(d) The results of paragraph (c) of this section, rounded to the nearest whole number, shall be included in the manufacturer's credit/debit totals calculated in § 86.1865–12(k)(5).

(e) The following values for refrigerant global warming potential (GWP_{REF}), or alternative values as determined by the Administrator, shall be used in the calculations of this section. The Administrator will determine values for refrigerants not included in this paragraph (e) upon request by a manufacturer.

(1) For HFC–134a, GWP_{REF} = 1430;

(2) For HFC–152a, GWP_{REF} = 124;

(3) For HFO–1234yf, GWP_{REF} = 4;

(4) For CO₂, GWP_{REF} = 1.

[77 FR 63165, Oct. 15, 2012]

§ 86.1868–12 CO₂ credits for improving the efficiency of air conditioning systems.

Manufacturers may generate credits applicable to the CO₂ fleet average program described in § 86.1865–12 by implementing specific air conditioning system technologies designed to reduce air conditioning-related CO₂ emissions over the useful life of their passenger automobiles and/or light trucks. Credits shall be calculated according to this section for each air conditioning system that the manufacturer is using to generate CO₂ credits. Manufacturers may also generate early air conditioning efficiency credits under this section for the 2009 through 2011 model years according to the provisions of § 86.1871–12(b). For model years 2012 and 2013 the manufacturer may determine air conditioning efficiency credits using the requirements in paragraphs (a) through (d) of this section. For model years 2014 through 2016 the eligibility requirements specified in either paragraph (e) or (f) of this section must be met before an air conditioning system is allowed to generate credits. For model years 2017 and later the eligibility requirements specified in paragraph (g) of this section must be met before an air conditioning system is allowed to generate credits.

(a)(1) 2012 through 2016 model year air conditioning efficiency credits are available for the following technologies in the gram per mile amounts indicated in the following table:

Air conditioning technology	Credit value (g/mi)
Reduced reheat, with externally-controlled, variable-displacement compressor (e.g. a compressor that controls displacement based on temperature setpoint and/or cooling demand of the air conditioning system control settings inside the passenger compartment).	1.7
Reduced reheat, with externally-controlled, fixed-displacement or pneumatic variable displacement compressor (e.g. a compressor that controls displacement based on conditions within, or internal to, the air conditioning system, such as head pressure, suction pressure, or evaporator outlet temperature).	1.1
Default to recirculated air with closed-loop control of the air supply (sensor feedback to control interior air quality) whenever the ambient temperature is 75 °F or higher: Air conditioning systems that operated with closed-loop control of the air supply at different temperatures may receive credits by submitting an engineering analysis to the Administrator for approval.	1.7

Air conditioning technology	Credit value (g/mi)
Default to recirculated air with open-loop control air supply (no sensor feedback) whenever the ambient temperature is 75 °F or higher. Air conditioning systems that operate with open-loop control of the air supply at different temperatures may receive credits by submitting an engineering analysis to the Administrator for approval.	1.1
Blower motor controls which limit wasted electrical energy (<i>e.g.</i> pulse width modulated power controller).	0.9
Internal heat exchanger (<i>e.g.</i> a device that transfers heat from the high-pressure, liquid-phase refrigerant entering the evaporator to the low-pressure, gas-phase refrigerant exiting the evaporator).	1.1
Improved condensers and/or evaporators with system analysis on the component(s) indicating a coefficient of performance improvement for the system of greater than 10% when compared to previous industry standard designs).	1.1
Oil separator. The manufacturer must submit an engineering analysis demonstrating the increased improvement of the system relative to the baseline design, where the baseline component for comparison is the version which a manufacturer most recently had in production on the same vehicle design or in a similar or related vehicle model. The characteristics of the baseline component shall be compared to the new component to demonstrate the improvement.	0.6

(2) 2017 and later model year air conditioning efficiency credits are available for the following technologies in the gram per mile amounts indicated for each vehicle category in the following table:

Air conditioning technology	Passenger automobiles (g/mi)	Light trucks (g/mi)
Reduced reheat, with externally-controlled, variable-displacement compressor (<i>e.g.</i> a compressor that controls displacement based on temperature setpoint and/or cooling demand of the air conditioning system control settings inside the passenger compartment).	1.5	2.2
Reduced reheat, with externally-controlled, fixed-displacement or pneumatic variable displacement compressor (<i>e.g.</i> a compressor that controls displacement based on conditions within, or internal to, the air conditioning system, such as head pressure, suction pressure, or evaporator outlet temperature).	1.0	1.4
Default to recirculated air with closed-loop control of the air supply (sensor feedback to control interior air quality) whenever the ambient temperature is 75 °F or higher; Air conditioning systems that operated with closed-loop control of the air supply at different temperatures may receive credits by submitting an engineering analysis to the Administrator for approval.	1.5	2.2
Default to recirculated air with open-loop control air supply (no sensor feedback) whenever the ambient temperature is 75 °F or higher. Air conditioning systems that operate with open-loop control of the air supply at different temperatures may receive credits by submitting an engineering analysis to the Administrator for approval.	1.0	1.4
Blower motor controls which limit wasted electrical energy (<i>e.g.</i> pulse width modulated power controller).	0.8	1.1
Internal heat exchanger (<i>e.g.</i> a device that transfers heat from the high-pressure, liquid-phase refrigerant entering the evaporator to the low-pressure, gas-phase refrigerant exiting the evaporator).	1.0	1.4
Improved condensers and/or evaporators with system analysis on the component(s) indicating a coefficient of performance improvement for the system of greater than 10% when compared to previous industry standard designs).	1.0	1.4
Oil separator. The manufacturer must submit an engineering analysis demonstrating the increased improvement of the system relative to the baseline design, where the baseline component for comparison is the version which a manufacturer most recently had in production on the same vehicle design or in a similar or related vehicle model. The characteristics of the baseline component shall be compared to the new component to demonstrate the improvement.	0.5	0.7

(b) Air conditioning efficiency credits are determined on an air conditioning system basis. For each air conditioning system that is eligible for a credit based on the use of one or more of the items listed in paragraph (a) of this section, the total credit value is the sum of the gram per mile values for the appropriate model year listed in paragraph (a) of this section for each item that applies to the air conditioning system.

(1) In the 2012 through 2016 model years the total credit value for an air conditioning system for passenger automobiles or light trucks may not be greater than 5.7 grams per mile.

(2) In the 2017 and later model years the total credit value for an air conditioning system may not be greater than 5.0 grams per mile for any passenger automobile or 7.2 grams per mile for any light truck.

Environmental Protection Agency

§ 86.1868-12

(c) The total efficiency credits generated by an air conditioning system shall be calculated separately for passenger automobiles and light trucks according to the following formula:

$$\text{Total Credits (Megagrams)} = (\text{Credit} \times \text{Production} \times \text{VLM}) \div 1,000,000$$

Where:

Credit = the CO₂ efficiency credit value in grams per mile determined in paragraph (b) or (e) of this section, whichever is applicable.

Production = The total number of passenger automobiles or light trucks, whichever is applicable, produced with the air conditioning system to which the efficiency credit value from paragraph (b) of this section applies.

VLM = vehicle lifetime miles, which for passenger automobiles shall be 195,264 and for light trucks shall be 225,865.

(d) The results of paragraph (c) of this section, rounded to the nearest whole number, shall be included in the manufacturer's credit/debit totals calculated in § 86.1865-12(k)(5).

(e) For the 2014 through 2016 model years, manufacturers must validate air conditioning credits by using the Air Conditioning Idle Test Procedure according to the provisions of this paragraph (e) or, alternatively, by using the AC17 reporting requirements specified in paragraph (f) of this section. The Air Conditioning Idle Test Procedure is not applicable after the 2016 model year.

(1) For each air conditioning system selected by the manufacturer to gen-

erate air conditioning efficiency credits, the manufacturer shall perform the Air Conditioning Idle Test Procedure specified in § 86.165-12 of this part.

(2) Using good engineering judgment, the manufacturer must select the vehicle configuration to be tested that is expected to result in the greatest increased CO₂ emissions as a result of the operation of the air conditioning system for which efficiency credits are being sought. If the air conditioning system is being installed in passenger automobiles and light trucks, a separate determination of the quantity of credits for passenger automobiles and light trucks must be made, but only one test vehicle is required to represent the air conditioning system, provided it represents the worst-case impact of the system on CO₂ emissions.

(3) The manufacturer shall determine an idle test threshold (ITT) for the tested vehicle configuration. A comparison of this threshold value with the CO₂ emissions increase recorded over the Air Conditioning Idle Test Procedure in § 86.165-12 determines the total credits that may be generated by an air conditioning system. The manufacturer may choose one of the following idle test threshold (ITT) values for an air conditioning system:

(i) 14.9 grams per minute; or

(ii) The value determined from the following equation, rounded to the nearest tenth of a gram per minute:

$$\text{Idle Test Threshold (ITT)} = 20.5 - (1.58 \times \text{Displacement})$$

Where:

Displacement = the engine displacement of the test vehicle, expressed in liters and rounded to the nearest one tenth of a liter.

(4)(i) If the CO₂ emissions value determined from the Idle Test Procedure in § 86.165-12 is less than or equal to the idle test threshold (ITT) determined in paragraph (e)(3) of this section, the total CO₂ efficiency credit value (Credit) for use in paragraph (c) of this section shall be the applicable value de-

termined in paragraph (b) of this section.

(ii) If the CO₂ emissions value determined from the Idle Test Procedure in § 86.165-12 is greater than the idle test threshold (ITT) determined in paragraph (e)(3) of this section, the total CO₂ efficiency credit value (Credit) for use in paragraph (c) of this section shall be determined using the following formula:

$$Credit = TCV \times \left[1 - \left(\frac{ITP - ITT}{6.4} \right) \right]$$

Where:

Credit = The CO₂ efficiency credit value (Credit) that must be used in paragraph (c) of this section to calculate the total credits (in Megagrams) of air conditioning efficiency credits;

TCV = The total CO₂ efficiency credit value determined according to paragraph (b) of this section; and

ITP = the increased CO₂ emissions determined from the Idle Test Procedure in § 86.165-14.

ITT = the idle test threshold determined in paragraph (e)(3) of this section and rounded to the nearest one tenth of a gram per minute:

(iii) Air conditioning systems that record an increased CO₂ emissions value on the Idle Test Procedure in § 86.165-14 that is greater than or equal to the idle test threshold (ITT) determined in paragraph (e)(3) of this section plus 6.4 grams per minute are not eligible for an air conditioning efficiency credit.

(5) Air conditioning systems with compressors that are solely powered by electricity shall submit Air Conditioning Idle Test Procedure data to be eligible to generate credits in the 2014 and later model years, but such systems are not required to meet a specific threshold to be eligible to generate such credits, as long as the engine remains off for a period of at least 2 minutes during the air conditioning on portion of the Idle Test Procedure in § 86.165-12(d).

(f) *AC17 reporting requirements.* Manufacturers may use the provisions of this paragraph (f) as an alternative to the use of the Air Conditioning Idle Test to demonstrate eligibility to generate air conditioning efficiency credits for the 2014 through 2016 model years. This paragraph (f) is required for the 2017 through 2019 model years.

(1) The manufacturer shall perform the AC17 test specified in § 86.167-17 of this part on each unique air conditioning system design and vehicle platform combination for which the manufacturer intends to accrue air conditioning efficiency credits. The manufacturer must test at least one unique

air conditioning system within each vehicle platform in a model year, unless all unique air conditioning systems within a vehicle platform have been previously tested. A unique air conditioning system design is a system with unique or substantially different component designs or types and/or system control strategies (e.g., fixed-displacement vs. variable displacement compressors, orifice tube vs. thermostatic expansion valve, single vs. dual evaporator, etc.). In the first year of such testing, the tested vehicle configuration shall be the highest production vehicle configuration within each platform. In subsequent model years the manufacturer must test other unique air conditioning systems within the vehicle platform, proceeding from the highest production untested system until all unique air conditioning systems within the platform have been tested, or until the vehicle platform experiences a major redesign. Whenever a new unique air conditioning system is tested, the highest production configuration using that system shall be the vehicle selected for testing. Air conditioning system designs which have similar cooling capacity, component types, and control strategies, yet differ in terms of compressor pulley ratios or condenser or evaporator surface areas will not be considered to be unique system designs. The test results from one unique system design may represent all variants of that design. Manufacturers must use good engineering judgment to identify the unique air conditioning system designs which will require AC17 testing in subsequent model years. Results must be reported separately for all four phases (two phases with air conditioning off and two phases with air conditioning on) of the test to the Environmental Protection Agency, and the results of the calculations required in § 86.167 paragraphs (m) and (n) must also be reported. In each subsequent model year additional air conditioning system designs, if such systems exist,

within a vehicle platform that is generating air conditioning credits must be tested using the AC17 procedure. When all unique air conditioning system designs within a platform have been tested, no additional testing is required within that platform, and credits may be carried over to subsequent model years until there is a significant change in the platform design, at which point a new sequence of testing must be initiated. No more than one vehicle from each credit-generating platform is required to be tested in each model year.

(2) The manufacturer shall also report the following information for each vehicle tested: the vehicle class, model type, curb weight, engine displacement, transmission class and configuration, interior volume, climate control system type and characteristics, refrigerant used, compressor type, and evaporator/condenser characteristics.

(g) *AC17 validation testing and reporting requirements.* For the 2020 and later model years, manufacturers must validate air conditioning credits by using the AC17 Test Procedure according to the provisions of this paragraph (g).

(1) For each air conditioning system selected by the manufacturer to generate air conditioning efficiency credits, the manufacturer shall perform the AC17 Air Conditioning Efficiency Test Procedure specified in § 86.167-17 of this part, according to the requirements of this paragraph (g).

(2) Complete the following testing and calculations:

(i) Perform the AC17 test on a vehicle that incorporates the air conditioning system with the credit-generating technologies.

(ii) Perform the AC17 test on a vehicle which does not incorporate the credit-generating technologies. The tested vehicle must be similar to the vehicle tested under paragraph (g)(2)(i) of this section and selected using good engineering judgment. The tested vehicle may be from an earlier design generation. If the manufacturer cannot identify an appropriate vehicle to test under this paragraph (g)(2)(ii), they may submit an engineering analysis that describes why an appropriate vehicle is not available or not appropriate, and includes data and information sup-

porting specific credit values, using good engineering judgment.

(iii) Subtract the CO₂ emissions determined from testing under paragraph (g)(1)(i) of this section from the CO₂ emissions determined from testing under paragraph (g)(1)(ii) of this section and round to the nearest 0.1 grams/mile. If the result is less than or equal to zero, the air conditioning system is not eligible to generate credits. If the result is greater than or equal to the total of the gram per mile credits determined in paragraph (b) of this section, then the air conditioning system is eligible to generate the maximum allowable value determined in paragraph (b) of this section. If the result is greater than zero but less than the total of the gram per mile credits determined in paragraph (b) of this section, then the air conditioning system is eligible to generate credits in the amount determined by subtracting the CO₂ emissions determined from testing under paragraph (g)(1)(i) of this section from the CO₂ emissions determined from testing under paragraph (g)(1)(ii) of this section and rounding to the nearest 0.1 grams/mile.

(3) For the first model year for which an air conditioning system is expected to generate credits, the manufacturer must select for testing the projected highest-selling configuration within each combination of vehicle platform and unique air conditioning system. The manufacturer must test at least one unique air conditioning system within each vehicle platform in a model year, unless all unique air conditioning systems within a vehicle platform have been previously tested. A unique air conditioning system design is a system with unique or substantially different component designs or types and/or system control strategies (e.g., fixed-displacement vs. variable displacement compressors, orifice tube vs. thermostatic expansion valve, single vs. dual evaporator, etc.). In the first year of such testing, the tested vehicle configuration shall be the highest production vehicle configuration within each platform. In subsequent model years the manufacturer must test other unique air conditioning systems within the vehicle platform, proceeding from the highest production untested

system until all unique air conditioning systems within the platform have been tested, or until the vehicle platform experiences a major redesign. Whenever a new unique air conditioning system is tested, the highest production configuration using that system shall be the vehicle selected for testing. Credits may continue to be generated by the air conditioning system installed in a vehicle platform provided that:

(i) The air conditioning system components and/or control strategies do not change in any way that could be expected to cause a change in its efficiency;

(ii) The vehicle platform does not change in design such that the changes could be expected to cause a change in the efficiency of the air conditioning system; and

(iii) The manufacturer continues to test at least one unique air conditioning system within each platform using the air conditioning system, in each model year, until all unique air conditioning systems within each platform have been tested.

(4) Each air conditioning system must be tested and must meet the testing criteria in order to be allowed to generate credits. Credits may continue to be generated by an air conditioning system in subsequent model years if the manufacturer continues to test at least one unique air conditioning system within each platform on an annual basis, unless all systems have been previously tested, as long as the air conditioning system and vehicle platform do not change substantially.

(h) The following definitions apply to this section:

(1) *Reduced reheat, with externally-controlled, variable displacement compressor* means a system in which compressor displacement is controlled via an electronic signal, based on input from sensors (e.g., position or setpoint of interior temperature control, interior temperature, evaporator outlet air temperature, or refrigerant temperature) and air temperature at the outlet of the evaporator can be controlled to a level at 41 °F, or higher.

(2) *Reduced reheat, with externally-controlled, fixed-displacement or pneumatic variable displacement compressor* means a

system in which the output of either compressor is controlled by cycling the compressor clutch off-and-on via an electronic signal, based on input from sensors (e.g., position or setpoint of interior temperature control, interior temperature, evaporator outlet air temperature, or refrigerant temperature) and air temperature at the outlet of the evaporator can be controlled to a level at 41 °F, or higher.

(3) *Default to recirculated air mode* means that the default position of the mechanism which controls the source of air supplied to the air conditioning system shall change from outside air to recirculated air when the operator or the automatic climate control system has engaged the air conditioning system (i.e., evaporator is removing heat), except under those conditions where dehumidification is required for visibility (i.e., defogger mode). In vehicles equipped with interior air quality sensors (e.g., humidity sensor, or carbon dioxide sensor), the controls may determine proper blend of air supply sources to maintain freshness of the cabin air and prevent fogging of windows while continuing to maximize the use of recirculated air. At any time, the vehicle operator may manually select the non-recirculated air setting during vehicle operation but the system must default to recirculated air mode on subsequent vehicle operations (i.e., next vehicle start). The climate control system may delay switching to recirculation mode until the interior air temperature is less than the outside air temperature, at which time the system must switch to recirculated air mode.

(4) *Blower motor controls which limit waste energy* means a method of controlling fan and blower speeds which does not use resistive elements to decrease the voltage supplied to the motor.

(5) *Improved condensers and/or evaporators* means that the coefficient of performance (COP) of air conditioning system using improved evaporator and condenser designs is 10 percent higher, as determined using the bench test procedures described in SAE J2765 "Procedure for Measuring System COP of a Mobile Air Conditioning System on a

Test Bench,” when compared to a system using standard, or prior model year, component designs (SAE J2765 is incorporated by reference in § 86.1). The manufacturer must submit an engineering analysis demonstrating the increased improvement of the system relative to the baseline design, where the baseline component(s) for comparison is the version which a manufacturer most recently had in production on the same vehicle design or in a similar or related vehicle model. The dimensional characteristics (e.g., tube configuration/thickness/spacing, and fin density) of the baseline component(s) shall be compared to the new component(s) to demonstrate the improvement in coefficient of performance.

(6) *Oil separator* means a mechanism which removes at least 50 percent of the oil entrained in the oil/refrigerant mixture exiting the compressor and returns it to the compressor housing or compressor inlet, or a compressor design which does not rely on the circulation of an oil/refrigerant mixture for lubrication.

[77 FR 63166, Oct. 15, 2012]

§ 86.1869-12 CO₂ credits for off-cycle CO₂-reducing technologies.

(a) Manufacturers may generate credits for CO₂-reducing technologies where the CO₂ reduction benefit of the technology is not adequately captured on the Federal Test Procedure and/or the Highway Fuel Economy Test. These technologies must have a measurable, demonstrable, and verifiable real-world CO₂ reduction that occurs outside the conditions of the Federal Test Procedure and the Highway Fuel Economy Test. These optional credits are referred to as “off-cycle” credits. Off-cycle technologies used to generate emission credits are considered emission-related components subject to applicable requirements, and must be demonstrated to be effective for the full useful life of the vehicle. Unless the manufacturer demonstrates that the technology is not subject to in-use deterioration, the manufacturer must account for the deterioration in their analysis. Durability evaluations of off-cycle technologies may occur at any time throughout a model year, provided that the results can be factored

into the data provided in the model year report. Off-cycle credits may not be approved for crash-avoidance technologies, safety critical systems or systems affecting safety-critical functions, or technologies designed for the purpose of reducing the frequency of vehicle crashes. Off-cycle credits may not be earned for technologies installed on a motor vehicle to attain compliance with any vehicle safety standard or any regulation set forth in Title 49 of the Code of Federal Regulations. The manufacturer must use one of the three options specified in this section to determine the CO₂ gram per mile credit applicable to an off-cycle technology. Note that the option provided in paragraph (b) of this section applies only to the 2014 and later model years. The manufacturer should notify EPA in their pre-model year report of their intention to generate any credits under this section.

(b) *Credit available for certain off-cycle technologies.* The provisions of this paragraph (b) are applicable only to 2014 and later model year vehicles. EPA may request data, engineering analyses, or other information that supports a manufacturer’s use of the credits in this paragraph (b).

(1) The manufacturer may generate a CO₂ gram/mile credit for certain technologies as specified in this paragraph (b)(1). Technology definitions are in paragraph (b)(4) of this section. Calculated credit values shall be rounded to the nearest 0.1 grams/mile.

(i) *Waste heat recovery.* The credit shall be calculated using the following formula, rounded to the nearest 0.1 grams/mile:

$$\text{Credit} \left(\frac{\text{g}}{\text{mi}} \right) = \text{ELR} \times 0.007$$

Where:

ELR = the electrical load reduction of the waste heat recovery system, in Watts, calculated as an average over 5-cycle testing.

(ii) *High efficiency exterior lights.* Credits may be accrued for high efficiency lighting as defined in paragraph (b)(4) of this section based on the lighting locations with such lighting installed. Credits for high efficiency lighting are the sum of the credits for the applicable lighting locations in the following